SYCAMORE PESTS

A Guide to Major Insects, Diseases, and Air Pollution

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SYCAMORE PESTS: A Guide to Major Insects, Diseases, and Air Pollution

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INTRODUCTION

This booklet will help nurserymen, forest woodland managers and homeowners to identify and control pest problems. Major insects and diseases are illustrated. Brief mention is made of other pests of local or sporadic concern. A list of registered chemical controls is included. This list is subject to change as new chemicals are approved. Revisions will be made available, periodically.

Be aware of the **preventive** measures available to you. Stress is mentioned in the following pages as a problem that complicates or precedes attacks by insects and diseases. Protect your trees from the stress of an unfavorable environment. Plant your trees on good soil. Assure that sufficient water, nutrients and sunlight are available for vigorous growth. Avoid stress from accidental injuries to your trees by taking care to prevent cuts, bruises, or torn limbs when you are working around your sycamores. Take prompt remedial action to control insects or diseases as soon as they are discovered. Stress from attack by one pest raises a tree's susceptibility to attack by other insects and diseases. For further information, contact your State Forester, county agent, or the nearest office of State and Private Forestry, Forest Service, USDA.

Sycamores (*Platanus occidentalis*) grow on a wide range of soil types. They can grow on wet or dry soils, but the best growth occurs on alluvial soils along rivers and minor stream bottoms. Natural stands of sycamore are found on the East Coast westward to the 100th meridian and between latitudes of 27 to 42. They appear in the northern part of Florida along stream bottoms and are found in the southern part of Maine, Vermont, and New Hampshire. Natural stands of sycamores occur in all States except Minnesota within the boundaries described above. In the South, they are an important component of natural stands, an important plantation species, and are commonly used as fast growing ornamental species.

Insects and diseases are continual threats to sycamores. Although most sycamore pests cause little or no mortality, they reduce growth and mar the tree's beauty. Cankers cause problems in localized areas. The danger may be intensified in large plantings which support a rapid build-up of damaging agents.

GLOSSARY

Blight – A disease with sudden, severe leaf damage and often with general killing of flowers and stems.

Callus – A thickened, hard swelling on a stem or branch; usually found on the edge of a canker or wound.

Canker – A lesion on a stem; a plant disease with sharply defined dead areas.

Conk – Spore-bearing, fungus structures found on trees, indicating wood rots or decays.

Coppice – A forest originating mainly from sprouts or root suckers from old stumps.

Frass – Wood fragments made by a wood-boring insect, usually mixed with excrement.

Generation – A complete life cycle of an insect, from egg to adult.

Larva (larvae) – An immature stage of an insect, frequently a worm.

Life cycle – A series of stages or changes in form and activity through which an organism passes through its lifetime.

Nymph – An immature stage that has some resemblance to an adult insect.

Parasites – Organisms that live in or on a host organism of another species and from which they obtain food and water.

Predators – Free living organisms which kill hosts quickly by attack and require numerous hosts so they may develop and live during their lifetime.

Pupa (pupae) – An immature, nonfeeding, inactive stage of an insect.

Pupate – Change in form of an insect in its development to an adult.

Saprophyte – An organism which feeds on lifeless organic matter.

INSECTS

FOLIAGE INSECTS

Lace Bug

Lace bugs, *Corythucha ciliata,* are potentially serious pests of sycamores throughout the eastern United States. The bug's name is based on the broad, gauze-like or lace-like wing covers of the adults (fig. 1). The nymphs, or immature stage, (fig. 2) are black, flattened, and covered with spines. Colonies of adults and nymphs injure the foliage by sucking the sap. Infested leaves become whitened and/or brownish, giving a mottled, stippled, or faded appearance similar to that of leafhopper and mite injury. The leaves of heavily infested trees may turn brown and drop prematurely.

Severe outbreaks of lace bugs are infrequent; however, a few minor outbreaks are common each year. Heavy infestations are most likely to be found on shade and ornamental trees in urban areas. Damage is most noticeable in late summer during periods of dry weather.

Adults overwinter by hibernating under loose, rough bark or in other sheltered places under, or near, the host tree. They emerge in the spring and ascend to the tender foliage. The young nymphs feed for 5 to 6 weeks on the under-surface of the leaves. They seldom leave the leaf upon which they hatched until nearly grown, when they begin moving about more freely. A generation – egg through adult stage – matures in 6 to 8 weeks; there are two to three generations per year.

Predators of nymphs of the sycamore lace bug help keep infestations in check. Natural enemies include predacious bugs (*Triphleps insidiousus* Say), chrysopid larvae, assassin bugs, spiders, and predacious mites. Chemical control may be necessary in late summer and early fall when lace bugs become numerous.

Figure 1.–Adult lace bugs feeding on underside of leaf.

Figure 2.–Nymph lace bugs feeding on underside of leaf.

Tussock Moths

The larvae (immature, or caterpillar, stage) of the whitemarked tussock moth, *Hemerocampa leucostigma,* attack sycamores and many other hosts throughout the Eastern States and as far west as Colorado. Young larvae skeletonize leaves and older larvae chew the entire leaf except for the main veins (fig. 3).

The male moth is ashy gray with dark wavy bands on the forewings and a wingspan of about 1.25 inch (32 mm). The female is wingless. The larva has a coral-red head. The body has a black stripe on the back and a grayish one on each side, and three long black hairline stripes. The sides of the body are covered in white and blackish hairs.

This insect spends the winter in the egg stage. Eggs are deposited in frothy, white masses on empty insect cocoons, and hatch between April and June. Larvae can spin down on silken threads and, when small, may be carried long distances by the wind. After 30 to 40 days, the larvae spin grayish cocoons under branches, in crevices, or in other sheltered places. A generation lasts about 7 weeks; there are three to four generations per year.

The sycamore tussock moth, *Halisidota harrisii,* feeds on sycamore and London plane trees, *Plantanus acerifolia,* and occurs wherever sycamores grow. One-half or more of the foliage may be eaten by the caterpillars. The larvae chew from the edge of the leaf and have yellowish bodies with whitish to yellow hairs (fig. 4). The life cycle of this insect parallels that of the white-marked tussock moth.

The tussock moths are very heavily parasitized by several species of wasps. The wasps deposit their eggs in the egg, larval, or pupal stage of the moth. Upon hatching, the wasp larvae consume their hosts. Tussock moths may be controlled in shade trees by pruning out conspicuous egg masses in winter and spraying the foliage in summer.

Figure 3.–Larvae of whitemarked tussock moth.

Figure 4.–Larva of sycamore tussock moth feeding on foliage.

Leafrollers

Several species of leafroller caterpillars feed on sycamore foliage within sheltered enclosures constructed by these insects. The larvae may consume only portions of the leaves, but the holes, folded leaves, and silken webs give infested trees a very ragged appearance (fig. 5). During heavy infestations, trees may be completely stripped of their foliage leaving only the main veins with portions of exposed silken webs.

The pale yellow larvae of *Anchylopera platanana* begin feeding at the base of the leaf between the main leaf veins (fig. 6). The larva spins a fine, silken web over the leaf surface where it rests and feeds. The web is extended as more feeding area is needed – frequently folding the entire leaf together. A life cycle requires about 6 weeks. There may be two or more generations per year.

Other leafrollers that feed on sycamore include *Tetralopha platinella, T. militella,* and *Adoxophyes furcatana.* The larvae of these species feed within silken tubes, under silken webs, or in leaf rolls and folds.

Parasites and predators usually prevent serious damage by leafrollers. Direct control measures may be needed on high-value trees during summer and fall.

Figure 5.–Moderately heavy feeding by leafrollers.

Figure 6.–Leafrollers feeding near leaf base.

Fall Webworm

The fall webworm, *Hyphantria cunea,* occurs throughout the United States. It is a well-known pest of more than a hundred deciduous trees. Except during an extreme abundance of these pests, the esthetic value of sycamore trees is affected most. The caterpillars spin large webs within which they feed (fig. 7). The webs are extended until they enclose individual leaves or even entire branches. A loose, unsightly, silken web mass may cover many leaves, twigs, and smaller branches during mid to late summer.

The moth is usually pure white but some have small, dark spots on the wings (fig. 8). Full-grown larvae are usually a pale yellow or green, with a broad dusky stripe down the back and a yellowish stripe down each side. The body is covered with whitish to reddish hairs.

Depending upon climate, one to four generations occur per year; in Louisiana, four are common. The eggs are laid in large masses of four to five hundred, usually on the undersides of the leaves. Most of them are laid in June and July, and hatch in about 10 days. Soon after hatching, the larvae spin silken webs (tents) over the foliage. The caterpillars live together in their "tents" and on nearby foliage until they are large enough to spin cocoons – a period extending from June to October. They overwinter as pupae in thin cocoons in the ground duff. Emerging moths may be found throughout the spring and summer.

Nature helps keep fall webworms under control through the activities of more than 50 parasites and 36 predators – all within the insect kingdom except for a number of spiders. When an outbreak is local, the most effective method of control is to cut out the web with its brood of caterpillars and burn it. In cases when webs are numerous or in tall trees, spray with an insecticide.

Figure 7.–Larvae of fall webworm feeding on foliage.

Figure 8.–Adult fall webworm.

Leafhoppers

Although the leafhoppers belong to one of the largest families of the insect kingdom, only three species cause about 90 percent of the infestations of sycamores: *Erythroneura lawsoni, E. arta,* and *E. usitata.* Five additional species have been reported on sycamores, but their incidence is low. Sap sucking by leafhoppers results in stippled, faded areas near the leaf base and along main veins (fig. 9). Heavy infestations may result in poor leaf color and premature defoliation in the fall. Leafhoppers are vectors of virus and mycoplasma diseases of plants.

Adults (fig. 10) overwinter in leaf litter and debris and become active in early spring. Following the opening of sycamore buds, female leafhoppers mate and lay eggs. An average generation develops from egg through adult in 41 days. Newly emerged adults feed, mate, and lay eggs within 5 days. With the onset of winter, adults seek hibernating sites and remain relatively inactive until spring.

Spiders, fungus diseases, and the physical action of rainfall and wind help to reduce leafhopper infestations. Chemical control may be needed occasionally on ornamental trees during summer and fall when leafhoppers become numerous.

Figure 9.–Right: chlorotic stippling from leafhoppers feeding on leaf. Left: healthy leaf.

Figure 10.–Adult leafhoppers feeding on leaf underside.

Mites

Although mites are not insects, they are related pests of sycamores and therefore they merit coverage in the same chapter with insects. Several mite species, *Tetranychus cinnabarinus, T. urticae, Oligonychus ilicis, O. platani,* and others, injure foliage like sapsucking insects. Mites spin fine webbing over the leaf surface and suck the sap from leaves, causing a characteristic blotching or stippling of whitish, yellow and, finally, brown patterns. During severe infestations, the entire foliage develops a rusty appearance and leaves drop prematurely.

Adult mites are not much larger than the period at the end of this sentence. They are oval, soft-bodied, and have eight legs. Mites overwinter as adults or eggs in protected places on the trunk of a tree or surrounding vegetation. Feeding begins in the spring and successive generations develop – 16 or more per year, for some species. Mite infestations are favored by extended periods of hot, dry weather. When mite populations are high and weather conditions favorable for mite development, chemical control may be necessary.

TWIG, BRANCH, AND TERMINAL INSECTS

Periodical Cicadas

Periodical cicadas, or locusts, *Magicicada* species, are distributed throughout the eastern United States. Cicadas puncture stems and branches and deposit their eggs under the surface. An example of such injuries is shown in figure 11. Injury is most serious to seedlings and transplanted stock. Damaged seedlings usually dieback. On large trees, injured branches often break or dieback, but damage is usually light.

Adult cicadas (fig. 12) emerge from their nymph stage of development from late April to early June. Females mate and begin laying eggs 7 to 10 days after emergence. Adults live 5 to 6 weeks. The female uses a curved, saw-like, egg-laying appendage to make a straight line series of egg punctures in the bark. Newly hatched nymphs fall to the ground and burrow to the roots for a 13- or 17-year underground life stage. Nymphs leave the ground by crawling to vegetation and other upright objects where they molt to the adult stage. The singing and drumming by males is loud and incessant and serves to alert landowners to check young plantings frequently for damage.

Damage can be reduced with insecticides properly timed with the egg-laying period during the spring and early summer. Individual plants and small ornamental plantings may be protected with netting during this period. Natural enemies include birds, insect and mite predators, and fungus diseases.

Figure 11.–Egg-laying punctures of adult periodical cicada on young stem.

Figure 12.–Adult periodical cicada.

Planthoppers

Planthoppers, *Ormenus venusta,* feed and lay their eggs primarily on woody vines and weeds; however, adults occasionally migrate from their usual hosts to sycamore seedlings during drought conditions in search of a place to lay their eggs. Heavy clusters of punctures made where the eggs were laid often kill terminals, branches, or entire seedlings (fig. 13). Most injury results from these punctures, although planthoppers also feed on the sap.

The adults feed in clusters (fig. 14) from June through August. Eggs overwinter inside the twigs of host plants. Nymphs develop to the adult stage in about 9 weeks. Direct control may be needed during the summer to prevent damage to seedlings caused by egg-laying punctures.

Figure 13.–Young sycamore terminal killed by punctures of egg-laying planthopper.

Figure 14.–Adult planthoppers feeding on young sycamore stem.

Stalk Borers

The stalk borer, *Papaipema nebris*, occurs throughout the eastern United States and has a wide host range. Borers are occasionally a pest of sycamore seedlings, terminals, and branch-ends of young trees. The larva tunnels into the stem causing it to dieback or break off, then migrates to another plant. Succulent, tender terminals of the current year's growth are preferred (fig. 15).

The larva is mostly dirty-white with a purplish brown band around the middle segments, and four, broad, purplish stripes extending forward to the head and backward to the end of the abdomen (fig. 16).

The eggs overwinter and hatch the following May or June. Newly hatched larvae feed on young grass and weeds before migrating to sycamores or other large-stemmed plants. Moths emerge from their cocoons in late August to early October. There is one generation per year. Direct control may be useful during summer months when terminal damage becomes noticeable in nurseries and young plantations.

Figure 15.–Young sycamore terminal killed by stalk borer tunneling.

Figure 16.–Larva of stalk borer.

Aphids

The sycamore aphid, *Drepanosiphum platanoides,* and the giant bark aphid, *Longistigma caryae* (fig. 17), are the two most common aphids on sycamores. These aphids usually occur in clusters on terminals, twigs, and small branches. Aphids feed by sucking the plant sap. Heavily infested twigs may be seriously weakened or killed. The excretions of aphids, called honeydew, serve as a medium for growth of sooty molds which detract from the appearance and photosynthesis of ornamentals.

The sycamore aphid is a large, pale or dark green, or reddish-yellow species with slightly dusky wing veins. The giant bark aphid reaches 0.24 inch (6 mm) in length, has long legs, and is covered with a bluish-white bloom. Both species produce winged and wingless forms. There may be 15 to 20 generations per year. Many predacious and parasitic enemies, as a rule, keep these aphids from becoming destructively abundant. Direct control may be needed occasionally on ornamental trees to maintain tree vigor and to prevent honeydew and sooty mold.

Figure 17.–Cluster of giant bark aphids on stem.

Scales

The terrapin scale, *Lecanium nigrofasciatum;* the European fruit lecanium, *Lecanium corni;* and the cottony maple scale, *Pulvinaria innumerabilis,* are of some importance on sycamores. Scale insects feed on plant juices. The foliage of heavily infested plants develops faded areas and may drop prematurely. Portions of twigs and branches may be killed. Scale insects look like an abnormal growth on the tree. However, beneath their shell-like cover, living specimens are soft and plastic; at death, the body becomes a hard, brown shell (fig. 18.).

Partly grown females overwinter on branches. Growth is completed in the spring and eggs are laid in early summer. Newly-hatched nymphs crawl to the undersurfaces of leaves and feed until preparing to overwinter. The overwintering stage varies from species to species.

Parasites and predators are important in regulating scale insects. Direct control is seldom needed except when scales become extremely abundant.

Figure 18.–Lecanium scale on stems.

TRUNK BORERS

Columbian Timber Beetle

The Columbian timber beetle, *Corthylus columbianus,* attacks the trunks of living, deciduous trees, including sycamores, throughout the eastern United States. This pest makes galleries in the sapwood of healthy trees, apparently without seriously impairing their health. The holes and associated stains (fig. 19) are evident in lumber and seriously reduce its value.

Adults become active during spring and frequently reattack the tree in which they develop. Holes are bored straight through the bark into the wood, usually at the base of the trunk. Entrance holes about the size of a pinpoint often ooze sap and frass (fig. 20). The beetles spend the winter in both the pupal and adult stages in their galleries. There are two to three generations per year. This beetle is more common on sycamores growing in flood plains, especially if these trees have been subjected to drought. Vigorous trees are often able to "sap-out" the attacking beetles. Therefore, management practices that promote tree vigor help to reduce infestations.

Figure 19.–Columbian timber beetle galleries and stain in sycamore lumber.

Figure 20.–Columbian timber beetle attack on sycamore trunk.

Clearwing Borer

A clearwing borer, *Ramosia resplendens,* occurs in the western range of sycamores. Larvae mine the bark, extrude reddish frass, and are the cause of dead, rough spots on the lower trunk and larger branches.

The adult borer is a clearwing moth with yellow and black bands on the abdomen. The larva is pinkish white with a reddish brown head. Larvae overwinter in bark tunnels. The larvae grow, pupate in cocoons in the outer bark, and emerge from May to August. There is one generation per year.

Trees are most susceptible to attack when under stress of any unfavorable conditions. Inadequate water, sunlight, or nutrients; poor soil, competition from weeds, vines or other nearby plants, as well as other insect and disease conditions may all put stress on a tree, especially young sycamores. Such conditions call for alertness for signs of infestations by borers or other pests. Practices favorable to tree vigor help to keep infestations in check. Bark wounds from equipment are attractive to clearwing borers and should be avoided. Infestations retard growth but seldom kill sycamores.

Flatheaded Borers

Flatheaded borers, *Chrysobothris femorata* and *C. mali,* have been recorded damaging newly transplanted trees. Damage from these borers can be detected by the sap exuding from spots on the trunk. Damage can be prevented or reduced by using borer-free planting stock and following good planting practices that promote tree vigor.

ROOT INSECTS

Whitefringed Beetles

Whitefringed beetles, *Graphognathus* species, are primarily pests of fields, gardens, and ornamental plants, but may seriously damage sycamore seedlings planted on infested sites. The larvae live in the soil and chew the surface layer of roots, often girdling or severing the taproot (fig. 21). Severely damaged plants turn yellow, wilt, and die, or become yellow and unthrifty.

Adult beetles are dark gray with a white fringe around the outer body. Larvae are yellowish white and legless. The soil-deposited eggs hatch in 17 days and the larvae begin feeding. Adults emerge the following summer. There is usually one generation per year.

New sites for nurseries and plantations in areas of known infestation, particularly along the Gulf Coast, should be selected carefully. Sites previously planted to preferred hosts such as soybeans, peanuts, and other legumes should be inspected carefully for larvae before planting.

Figure 21.–Whitefringed beetle larvae and feeding injury to 1-year-old sycamore root.

DISEASES

FOLIAGE DISEASES

Foliage diseases reduce the attractiveness and growth of trees. Repeated defoliation may put a tree under stress, which makes it more susceptible to wilts, cankers, or root diseases, as well as insects.

Chemical controls in natural forest stands are not feasible. However, management practices to enhance tree vigor will reduce losses. Effective chemicals are available for use on ornamental trees (see the last chapter).

Anthracnose

The most important sycamore leaf disease is anthracnose caused by the fungus *Gnomonia platani,* which occurs in all geographic areas. The fungus attacks foliage when the leaves are very small (fig. 22).

This disease causes many symptoms on the tree. Severe leaf defoliation is usually followed by growth of new leaves. The diseased leaves may have irregular brown areas on the veins, midribs, and leaf tips. The entire leaf blade may appear brown and wilted, as with frost damage. Close examination of infected leaves will show pinhead size, cream-colored spots on the underside of the leaves on dead tissues along the veins. Damage can also occur on the twigs, which results in shoot blight and small cankers (fig. 23). The severity of the outbreak is usually related to mild temperatures and prolonged rains. The fungal spores are spread by wind and rain. Leaf infection and shoot blight decrease with increased temperature. When the mean daily temperature exceeds 60° F (15° C), the disease is arrested. Early fall defoliation occurs during years when temperature and rain favor disease development. In the mid-South, the disease may also occur in the fall.

Figure 22.–Terminal killed by anthracnose fungus.

Figure 23.–Twig canker develops from leaf infection.

Mycosphaerella Leaf Spots

Other leaf diseases may also occur in localized areas in the summer. For example, the leaf spot disease caused by *Mycosphaerella platanifolia* (fig. 24) appears as small, irregular, brown spots which may coalesce until the entire leaf dies.

Figure 24.–Mycosphaerella leaf spots.

Powdery Mildews

Powdery mildews, *Microsphaera alni* or *Phyllactinia guttala,* deform and stunt newly formed leaves. Mildew is easily recognized by the white, powdery spore masses on the leaf surface. The heaviest spore masses are generally on the underside of the leaves.

Miscellaneous Leaf Spots

Leaf spots are also caused by *Septoria platanifolia* and *Phloeospora multimaculans.* Leaves infected by *S. platanifolia* develop brown, circular spots; the center later becomes tan to gray with a dark margin. *P. multimaculans* causes dark brown or purple, irregular, circular or angular spots about the size of a pinpoint. These leaf spots are usually of minor importance.

CANKER DISEASES

Canker Stain

Canker stain is caused by the fungus *Ceratocystis fimbriata platani.* This disease, spread by man on pruning tools, has devastated plantings of the London plane tree in urban areas since the 1930's. Recently, this disease has caused losses of 30 percent or more in localized areas of a few to 100 acres (40 ha) in sycamore plantations and natural stands in the lower Mississippi valley. Canker stain appears to be present throughout most of the South where sycamores occur. It is a potentially serious threat to natural stands and plantations.

Canker stain is difficult to detect in the early stages, but a varied combination of symptoms is helpful. The crowns of older trees get progressively thinner for a few years before the trees die or before other obvious advanced symptoms appear (fig. 25). Leaves on affected trees may be smaller and fewer than normal; twig dieback is common. Small branches usually develop on the stem. Diseased trees typically have slightly spiraling, long, narrow, flat cankers on the main stem or large branches which may remain bark-covered and obscure (fig. 26). Callus ridges are not obvious. Wood beneath cankers is stained and later decayed (fig. 26A). In advanced stages, cankers are marked by decay. Insect and bird damage may make them quite obvious if they are not vine-covered (fig. 27). Although top breakage is common, some trees die without decline or top breakage. Trees may be killed in a few months to about 7 years, depending on their age. Cankers are from 3 to 66 feet (0.9 to 20 m) long and may increase by about 10 feet (3 m) or more in a year, in the South. Canker width increases an average of 5 inches (9 cm) per year.

Cankers can best be detected by chipping away the bark with a hand ax; however, this exposes the microscopic spores which serve to spread the fungus. Since spores can remain viable on tools for a month or longer, the tools should be sterilized in denatured alcohol or laundry bleach (5.25 percent sodium hypochlorite) before use on healthy trees not marked for felling. Spores may also be disseminated by wind, rain, and insects. Infection may enter through fire or logging wounds, bark fissures or insect damage. Losses can best be reduced with early detection and harvesting of diseased trees. Sanitation cuts of an unmerchantable stand are recommended when adjacent sites are to be planted to sycamore. Care should be taken to avoid damage and subsequent infection of healthy trees remaining in the stand.

Cankers may result from other fungal infections and may appear similar to canker stain, especially on younger trees in plantations.

Figure 25.–Thin crown of a sycamore with the canker stain disease.

Figure 26. 26A.–A recent canker stain canker, before and after bark removal.

Figure 27.–Canker stain several years old with decay and bird damage.

Figure 28.–Inactive Botryodiplodia canker surrounded by callus on a sycamore stem.

Figure 29.–Active Botryodiplodia canker without surrounding callus on a sycamore stem.

Botryodiplodia Canker

Another canker disease in sycamore is caused by *Botryodiplodia theobromae.* Botryodiplodia cankers and dieback can be a serious threat to sycamores in both plantations and natural stands. They can kill, weaken, and deform trees.

Old and inactive Botryodiplodia cankers are usually flattened or sunken with callus surrounding the dead bark and the first layer of cells under the bark (fig. 28). New and actively growing cankers, however, are not surrounded by callus and may show no contrast in appearance with healthy bark except where the bark is normally smooth and light colored (fig. 29). Many black fungal fruiting structures no larger than a pinpoint can often be seen breaking through the dead bark. Because Botryodiplodia cankers resemble other cankers on sycamore, it may be necessary to examine the fungal spores microscopically before a positive identification is made. Cankers can be on any part of the trunk, limbs, and small twigs. However, they have been observed most often in twigs and limbs.

Cankers and dieback often begin at wounded and broken twigs, after which they advance downward into larger limbs and finally the main stem. These cankers are initiated primarily by spores which are spread by wind, insects, and even man. Spores may also be spread for short distances in windblown and splashing rain.

Temperature, tree vigor, and virulence of the strain of *B. theobromae* can affect canker development. Botryodiplodia cankers are most active during hot, summer months. Wilted trees that are suffering from drought are more vulnerable to cankers than are vigorous trees. However, some strains of the fungus are more virulent than others and can cause cankers even in vigorous trees. Less virulent strains may cause cankers only in trees that are under the stress of other adverse conditions.

Botryodiplodia cankers and dieback can be reduced in sycamore plantations by planting on good sites. Pruning, thinning, and harvesting (where coppice growth is used for regeneration) should be done during the fall and winter when the temperature is 68° F (20° C) or less and the fungus is inactive.

Hypoxylon Canker

Hypoxylon tinctor has occasionally been observed on sycamores. The fungus was noted as a saprophyte growing on dead sycamores long before it was known as a canker producer. The Hypoxylon cankers closely resemble Botryodiplodia and Ceratocystis cankers on sycamore. However, they can be separated by careful examination. Hypoxylon cankers appear mostly on the main stem and larger branches. The advancing margins of the cankers are often irregular and inconspicuous and may follow the grain of the wood. The inner bark and cambium in cankered areas are generally light orange. Older cankers may be sunken and longitudinal cracks often appear at points of physical stress. The fungal fruiting structures (stromata) appear on the bark and are dark brown to black; they are hard, and about 0.4 to 6 inches (1 to 15 cm) in length (fig. 30).

A noticeable number of Hypoxylon cankers has been observed in heavily thinned natural stands where sunscald occurs on newly exposed trunks. Cankers have also been observed in stressed or "declining" sycamores. The fungus does not appear to be able to cause cankers on vigorous, growing sycamores. Therefore, if tree vigor is maintained, Hypoxylon cankers should not be a major problem.

Figure 30.–Small Hypoxylon canker on a sycamore stem.

Figure 31.–Dothiorella canker with developing callus tissue.

Figure 32.–Phomopsis canker on a site-stressed tree.

Miscellaneous Canker Fungi

Two additional fungi, *Phomopsis* species and *Dothiorella* species, can cause dieback and cankers. On vigorous trees, Dothiorella cankers are arrested during the growing season and develop a sunken face or callus over completely (fig. 31). Phomopsis cankers may develop over several inches to a few feet and kill sycamores under environmental conditions which limit growth or cause stress (fig. 32). Such cases involving large cankers can be mistaken for one of the more serious canker diseases mentioned earlier. Cankers appear to develop the most at temperatures below 75° F (24° C). Affected trees may go unnoticed during the fall, produce small, off-color leaves in the spring, and may die within a few weeks. Small branches may be produced on the stem. The fungi produce inconspicuous, minute, flask-shaped reproductive structures in the diseased tissues. Numerous spores are released and are spread by the wind, rain, or other mechanical means. Germinating spores enter adjacent trees through wounds, twigs killed by anthracnose or other causes, or through injuries from insects, frost or mechanical damage.

Care should be taken to avoid wounding trees, planting of sites subject to environmental conditions leading to tree stress and planting trees out of their normal geographic area. These precautions should minimize losses to these two cankers.

WILTS

Cephalosporium wilt is a fungus disease observed in sycamores of east Texas. The disease is found mostly in urban areas.

Wilt symptoms include brown leaves, defoliation, twig dieback, and production of small branches (fig. 33). Leaves may grow back on twigs that have been defoliated. However, the new leaves are generally much smaller than normal and are often pale or yellowish. Brown leaves may appear on one to a few twigs or they may appear on the entire tree (fig. 33A). Leaves at or near twig terminals are usually the first to develop symptoms. Leaf symptoms are recurrent on the same twigs each year until the twigs die. The disease develops progressively in a tree as years pass and may eventually affect the foliage on almost all the twigs. Symptoms first appear in late May or early June and continue to develop throughout the summer. The wilt is favored by temperatures of 85° F (30° C) or higher. a tree may live several years before it is killed by Cephalosporium wilt alone. The wilted trees, however, are highly vulnerable to *Botryodiplodia theobromae,* which can kill stressed trees in one growing season. Cephalosporium wilt has been controlled experimentally in shade trees by drenching the trunks and spraying the foliage with a systemic fungicide.

Other vascular wilts, such as those caused by *Fusarium* and *Verticillium* fungi, are common in some other woody plants, but have not been reported in sycamore. Other tree problems can be easily mistaken for wilt. Construction damage to trees in urban areas can be mistaken for wilt. When cement is poured around the base of trees, roots are cut, or soil is filled around trees, sycamores often exhibit symptoms similar to Cephalosporium wilt. Many die if corrective measures are not taken. Root rots may also produce symptoms similar to those of wilt.

Figure 33.–Sycamore tree with Cephalosporium wilt on all twigs.

Figure 33A.–Typical Cephalosporium wilt symptoms on sycamore leaves.

ROOT ROTS

Armillaria Root Rot

Armillaria root rot, caused by the fungus *Armillaria mellea,* exists worldwide. Trees planted outside their natural range are quite susceptible. Drought also favors the disease. Trees infested by defoliating or bark-boring insects and infected by other fungi are also vulnerable to attacks by *A. mellea.* The disease is not fatal to vigorous trees, but may kill or seriously damage less healthy trees.

In most cases, root rots are difficult to diagnose. The first obvious symptom in mature trees is decline in vigor, as shown in unseasonally faded and dying leaves that fall prematurely. The remaining leaves may be smaller than normal. Foliage on young trees, 1 to 10 years old, may die simultaneously but remain on the trees throughout the season. Root collars and roots of trees with top symptoms should be examined for signs of decay. These signs include areas of decayed bark or wood, a fan-shaped white fungus mat between the bark and wood at the root collar, and dark brown or black shoestring-like structures attached to roots or in the soil.

Clitocybe Mushroom Root Rot

Clitocybe mushroom root rot, prevalent in the South, is caused by *Clitocybe tabescens*)fig. 34). Symptoms produced by *C. tabescens* are similar to Armillaria root rots; identification requires careful examination of the conks.

Figure 34.–Mycelial mat on surface of roots and root crown.

Corticium Root Rot and Poria Root Rot

Two similar root rots in sycamore plantations are Corticium and Poria. *Corticium galactinum* and *Poria latemarginata* produce a thick white fungal mat on the root collar. The latter also produces a small flat conk near the ground line (fig. 35). The lateral and feeder roots are destroyed. Young tree roots are killed, but 1 or 2 years may elapse before the tree dies.

Poria root rot appears to be more severe on poorly drained sites and can kill sycamores in first-year plantations. Disease control in plantations can be achieved by improving drainage and removing diseased trees to reduce spread. Mortality can be minimized by management practices that produce vigorous trees.

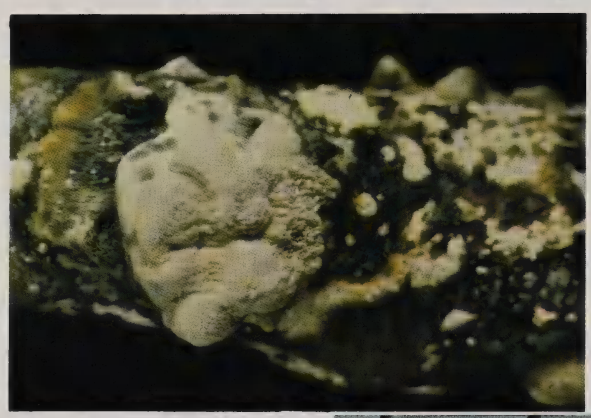

Figure 35.–Poria canker on root crown of young sycamore.

Figure 36.–Sycamore seedlings with root damage (left), and normal roots (right).

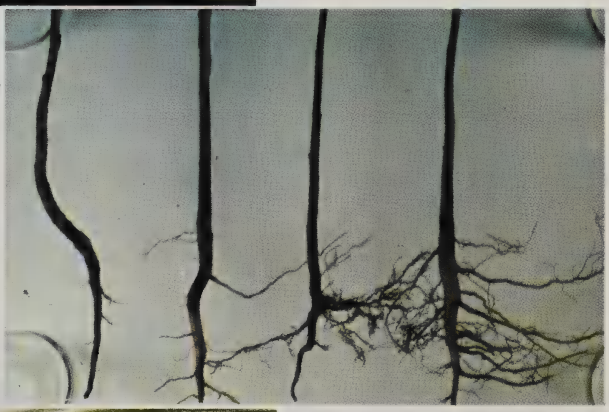

Figure 37.–Healthy seedling in foreground and root rot infected seedlings in background.

Cylindrocladium Root Rot and Fusarium Root Rot

Sycamore seedlings are moderately resistant to most root diseases. *Cylindrocladium scoparium* and *Fusarium solani* cause feeder root damage (fig. 36). In most cases, the disease is undetected unless the roots are severely infected. During epidemics, seedlings develop top symptoms. Infected seedlings may also develop fall coloration in early summer (fig. 37). Severely infected seedlings usually die before they are large enough to transplant.

Root diseases in nurseries can be controlled by several soil fumigants. Proper chemical applications in fall or spring will help ensure healthy seedlings.

DECAYS

Sycamore is subject to butt rot (fig. 38) and top rot throughout the South. The presence of branch scars in the top, butt bulge, butt scars, or fungus conks are good indicators of decay. The incidence of butt rot is somewhat less than the 40 percent average of all other southern hardwoods. Approximately one-half of the trees can be expected to have some top decay which enters through branch scars. Decay can be expected in 25 percent of the branch scars 2 inches (5 cm) in diameter and in 60 percent of those 3 inches (7.6 cm) or greater in diameter. The length of decay may reach 29 feet (9 m). The average expected length of decay can be estimated by scar diameter (table 1).

Table 1. – Scar diameter and expected decay length.

Decay	Scar Size					
	Small: 1-3 inch (2.5-7.6 cm)		Medium: 4-6 inch (10.2-15.2 cm)		Large: 7-10 inch (17.8-25.4 cm)	
	Recent	Old	Recent	Old	Recent	Old
Length	.2 ft. (.06 m)	.2 ft. (.06 m)	.9 ft. (.27 m)	.9 ft. (.27 m)	3.6 ft. (1.1 m)	5.0 ft. (1.5 m)

Decay may be caused by 30 or more different fungi. The most common encountered genera are *Hericium, Fomes, Poria, Lentinus, Polyporus.* Conks are produced yearly or when the tree dies and decays. Large numbers of spores are released for a period that varies from a few days to several months. The spores are carried by the wind to scars where germination and invasion occur.

Losses caused by decay can be reduced best by preventing injuries during logging operations or by fire prevention. Early detection and harvesting of decaying trees can also reduce volume losses and provide growing space for healthy trees.

Figure 38.–Butt scar on sycamore and resulting decay.

AIR POLLUTANTS

AIR POLLUTANTS

Air pollutants that can injure sycamores include ozone, sulfur dioxide, fluoride, and ammonia. Because of the complexities involved in determining air pollution injury, diagnosis should be conducted only by persons with extensive training and experience. Sycamores are relatively resistant to ozone and relatively tolerant of sulfur dioxide and fluoride. Diagnosis of suspected cases of air pollution injury is based on the type of foliage symptoms; occurrence of similar foliage symptoms on several plant species in the same area; types and quantities of pollutants that may have been present when injury occurred; and many other factors. Extreme care must be taken to distinguish between symptoms of air pollution injury and symptoms caused by insects, fungi, heat or drought stress, or other causes.

Symptoms of air pollution injury vary by type of pollutant. Ozone injury appears as small bleached or pigmented spots on the upper leaf surface. Sulfur dioxide injury appears as a wound or dead area of tissue between the leaf veins. Fluoride injury appears as a dead area of tissue on the leaf margin or spots of dead or dying tissue betwen the veins (fig. 39). Ammonia injury appears first as faded leaf margins, and dead or dying tissues with green islands mostly near veins (fig. 40).

Figure 39.–Fluoride injury.

Figure 40.–Ammonia injury.

TREATMENTS

TREATMENTS

EPA-registered chemicals[1] for control of insects and diseases that attack sycamores. (See labels for dosages and application methods.)

Insect	Insecticide	Host registered on
Lace bugs	Disulfoton	Ornamental trees
	Malathion	
	Carbaryl	
Tussock moths	Naled	
	Methoxychlor	
Leafrollers	Carbaryl	
Fall webworms	Carbaryl	
	Malathion	
	Bacillus thuringiensis	Ornamental & Others
Leafhoppers	Carbaryl	Ornamental trees
	Malathion	
Mites	Dicofol	
Periodical cicadas	Carbaryl	
Aphids	Diazinon	
	Malathion	
	Disulfoton	
Scales	Diazinon	
	Malathion	
	Dormant oil spray	
Trunk borers	Lindane	

Disease	Fungicide	Host registered on
Leaf spots & blotches	Zineb	Sycamore
Anthracnose	Zineb, or captafol	Sycamore
Powdery mildew	Wettable sulfur or dinocap	Ornamental trees
	Folpet	
Root diseases (*Cylindrocladium, Fusarium*)	Methyl bromide	
	Dowfume MC-33®	
Canker	Treat cankers with protective paint	

[1] Mention of trade names is solely to identify materials and does not imply endorsement or warranty by the U.S. Department of Agriculture.

CAUTION

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key – out of the reach of children and animals – and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

Use Pesticides Safely

FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE